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AN EVALUATION OF TREE MORTALITY AT SLY CREEK RESERVOIR, PLUMAS NATIONAL FOREST

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ABSTRACT

A 20-acre, 20-year-old plantation on the west shore of Sly Creek Reservoir was examined for tree mortality. A portion of the plantation on the lake shore is being considered as a future developed recreation area. The ponderosa pines are retarded in growth and form because of poor site quality, unknown seed source, and ponderosa pine resin midge. Sugar pines are being severely damaged and killed by white pine blister rust. Pine hybrids (knobcone X Monterey) are having periodic top breakage because of snow. Alternatives are presented that address the specific pest problems and discuss the construction of the recreation site and thinning of the surrounding plantation.

INTRODUCTION

On April 26, 1982 we met with Cleburne Smith and Bernie Sullivan from the La Porte Ranger District and visited a plantation on the west shore of Sly Creek Reservoir at Lewis Flat. The 20-acre plantation is about 20-years-old and was planted after the completion of the dam and reservoir. Species planted include ponderosa pine, sugar pine, giant sequoia, knobcone x Monterey pine, and Jeffrey x (Jeffrey x Coulter) pine. The seed sources for these trees are not known, but probably include a wide number and variety of sites. Douglas-fir, white fir, incense-cedar, and madrone have seeded into parts of the plantation. Prior to planting, the area had been excavated of soil for dam construction and then fertilized. It was fertilized again in 1981.

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On the east side of the road, next to the reservoir, a recreation site for overnight use has been proposed for construction. Construction would include placement of roads, camping sites, and facilities and would necessitate some tree removal. Concerns over the appropriateness of this site and the vegetation to maintain in the campground were expressed by District personnel.

OBSERVATIONS

Many of the trees, especially ponderosa pine, are suffering from off-site planting and low site quality. This is resulting in stunted growth, twisting, and deformities of the trees. Some of the ponderosa pines are being attacked by pine resin midge (Cecidomyia piniinopsis) which are killing and deforming branches. Trees with the heaviest and most obvious injury are in the proposed recreation area.

The sugar pines are undergoing the most significant injury because of infection by white pine blister rust (Cronartium ribicola). This fungus is killing trees, tree tops, and branches and will eventually eliminate the majority of sugar pines from the plantation. Most of the recent cankers originated in 1976, a rust "wave year" in California. These years of apparently optimum rust infection occur, on the average, every ten years, so that this plantation will probably undergo significant infection at least once more before it outgrows the period of highest susceptibility to infection.

The knobcone x Monterey pine hybrids have been growing rapidly in height, but the long, whip-like tops are breaking during the winter from accumulations of snow and ice. The result has been forking in the crowns, increased green slash in the spring, and increased clean-up costs. At least one group of these trees has been killed by red turpentine beetles (Dendroctonus valens); however, these trees were stressed by their location in a seasonal drainage.

BIOLOGY OF PEST ORGANISMS

Pine Resin Midge - Cecidomyia piniinopsis.

This small fly attacks the current year's shoots of living trees, principally ponderosa pine, causing needle and twig mortality and distorted growth. Severe infestations can stunt and deform crowns, but rarely kill trees. Damage is often heaviest in younger plantations where a non-local seed source was used.

Dead first-year foliage, dead and dying twigs, twig galls, and twisted terminal growth are indicators of resin midge attacks. These symptoms result from larvae boring in the vascular tissues of twigs; the severity of damage dependent on the number of larvae in the twig. Numerous larvae can girdle a shoot. Usually, however, the larvae are on one side of a shoot, reducing the growth on that side while the opposite side grows normally resulting in twisting of the twig. If the shoot survives, these feeding areas heal over with time and develop into the recognizable galls.

Resin midge adults fly and mate in the spring and lay their eggs on expanding shoots. Larvae emerge from the eggs shortly thereafter and bore into the shoot until they embed themselves in the vascular tissue. The larvae, surrounded by resin, feed in these cavities until the following year. In late winter to spring the larvae emerge and pupate, usually on the needles. In about two weeks the adults emerge, completing one generation per year.

There are marked differences in the susceptibility of ponderosa pine to the resin midge. In native stands, about one third of the trees are usually quite susceptible. The ponderosa pine seed source used near the picnic area apparently contained a very high proportion of seed collected from trees susceptible to the resin midge. The hazard of resin midge damage can be reduced in the stand by removing trees during thinning operations which have evidence of repeated attacks. Host vigor seems to have little to do with susceptibility to attack by this insect, but the effects of the larval feeding are much more severe on slow growing trees.

White Pine Blister Rust - Cronartium ribicola.

White pine blister rust, a non-native fungus, is an obligate parasite of 5-needle pines, principally sugar pine in California. When infected, sugar pines may suffer branch mortality, top killing, and tree mortality. It is most damaging to trees pole-size and smaller.

Infection of current season's needles occurs in the fall and the fungus then grows into the twig, forming a canker. In 2 to 3 years an exudate containing pycniospores appears on the canker. This stage is believed to have a sexual role for the fungus. The following spring, white spore sacs containing aeciospores erupt from the canker. These spores are wind-disseminated to the alternate host, species of Ribes, and infect the leaves. In several weeks orange pustules mature on the underside of infected Ribes leaves. These urediospores serve to intensify the rust infection by reinfecting Ribes. In the fall, hairlike telia emerge from the uredia pustules and produce basidiospores which are then wind-disseminated to pine foliage, completing the cycle. Environmental conditions are critical during the infection processes and this limits the disease most years. Therefore, most infections occur in certain years of optimum conditions, approximately once every ten years. During these "wave years" very high levels of infection can occur resulting in the loss of a large proportion of sugar pine in a young stand.

MANAGEMENT ALTERNATIVES

1. No Action. Present management plans will proceed, including construction of the recreation site and thinning of the plantation. The longevity of the sugar pine will be limited, with only a small proportion surviving to pole-size or larger, either from rust resistance or disease escape. Many of the ponderosa pines will be deformed and retarded in growth with dead twigs and thin crowns. Selection of residual trees without regard for midge damage during campground construction and thinning will result in limited growth and a less than attractive campground. The hybrids will

continue to undergo periodic top breakage during winter storms. This increase in forks might result in hazardous tree conditions in the recreation area during heavy-use periods.

Introducing a recreation area into this plantation could also result in additional tree problems in the future if management of the vegetation does not occur during and following construction. Because of proximity to the reservoir, usage of the area would probably be high, resulting in additional stress to the trees and premature mortality. If care is not taken during the placement and construction of roads, units, and facilities, then undue tree mortality can be expected.

2. Sugar Pine Management.

a. No action. Most of the sugar pine would die over the years. Few pole-size or larger stems would be produced during the life of the stand.

b. Pruning. Selected individuals may be pruned of branch infections following certain guidelines to increase the lives of the trees. A pruning operation is expensive and it may be that it could be economically justified only in the proposed recreation area.

Branch cankers can be separated into two groups based on the ability of the fungus to grow into the main bole and kill the tree. Lethal cankers are those within 24 inches of the bole that can enter the bole before the branch dies. Nonlethal cankers are more than 24 inches from the bole with the result that the branch will die before the fungus reaches the bole. In a pruning process, nonlethal cankers are not of concern. Lethal cankers are considered either prunable or nonprunable depending on their location. Prunable lethal cankers are more than 4 inches from the bole and in the lower two-thirds of the crown, or within 16 feet of the ground, whichever is less. Nonprunable lethal cankers are within 4 inches of the bole. Lethal cankers in the upper third of the crown or greater than 16 feet from the ground, whichever is less, are also nonprunable. When pruning selected trees, all branches in the lower two-thirds of the crown or up to 16 feet, whichever is less, should be removed. This will assure removal of undetected infections and reduce the probability of future infection. Uninfected or nonlethally infected trees could also be pruned of these lower branches, reducing the likelihood of future infection.

3. Campground Vegetation Management.

a. Location of units. During the planning of a recreation area, many factors need to be considered in the locating of roads, spurs, and facilities. Among these should be pest and vegetation conditions since uninformed decisions at the time of implementation can have long-lasting adverse effects. In the proposed Sly Creek recreation area, no pests, such as root diseases or dwarf mistletoes, were apparent that might influence development of plans at specific locations. However, allowing for adequate root space and planning facilities to minimize compaction from vehicles, trails, and foot paths will be significant in reducing future tree mortality.

b. Tree selection. Prior to construction, individual trees will be selected for retention in the recreation area. Attempts should be made to promote a mixed species stand, including hardwoods and brush, at a stocking level below what would be acceptable in a timber stand because of the increased stresses from recreational use. The area between the road and the Reservoir apparently has a site index of 40 or less.

Specifically, ponderosa pines with heavy resin midge attacks should be discriminated against, as should lethally infected, nonprunable sugar pines. Pruning sugar pines of their lower branches could be beneficial in retaining this species in the recreation area if they have no bole infections or infections within 4 inches of the bole. The pine hybrids should be discouraged in heavily used areas or near permanent facilities because of their hazard potential. Any trees that incur significant damage, especially of the roots or lower bole, during construction should be removed.

c. Regeneration. In certain situations, too few trees may be available to meet objectives or it may be advisable to remove the existing trees and start anew. Regenerating with native trees from a proper seed source will provide the best future stand. In addition to conifers, consideration should be given to native hardwoods, such as California black oak, in order to further diversify the species mix. Another option in certain situations is to plant or promote brush species that could provide screening and divert foot traffic from sensitive areas. It must be remembered that brush will utilize soil water and nutrients and, therefore, stocking levels of trees may need to be adjusted downward where brush will be heavy.

4. Plantation Thinning. A precommercial thinning is planned for the plantation outside of the proposed recreation area. Tree selection should consider many of the items discussed in 3 b. that deal with resin midge and blister rust. Other than consideration of these two pests, selecting for growth, form, and spacing should be adequate and beneficial. In the stands of pine hybrids a very light thinning is all that is advisable. Opening the canopy too much could result in excessive top breakage or windthrow. Following the thinning, proper slash disposal is necessary to minimize the potential for damage from pine engraver beetles (Ips spp.). Slash modifications which usually reduce the breeding success of pine engravers include lopping and scattering the slash in sunny areas or crushing the slash with logging machinery. Piling the slash while green or allowing fresh slash to remain in contact with leave trees can result in losses in the residual stand.